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Magnetic behaviour of $PrFe_4Sb_{12}$ and $NdFe_4Sb_{12}$ skutterudites

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Arc melted compounds $PrFe_4Sb_{12}$ and $NdFe_4Sb_{12}$ were investigated with respect to structural, magnetic and transport properties. Both compounds, isotypic with the filled skutterudite-type $LaFe_4P_{12}$, order magnetically below 5 and 16.5 K, respectively. Magnetic order is inferred in both cases from magnetisation, specific heat in magnetic fields and preliminary neutron studies. Magnetism arises from both the rare earth as well as the polyanion $[Fe_4Sb_{12}]$ sublattice. The observed effective moments of 4.19 and 4.44 μ_B, yield a significant polyanion contribution of $\mu_{\text{eff}} = 2.7$ and $3.1\mu_B$, respectively, assuming theoretical rare earth moment values. The polyanion part is consistent with trivalent iron in a low-spin d^5 electronic configuration with a net spin $s = 1/2$. $PrFe_4Sb_{12}$ exhibits an unusual high electronic contribution to the specific heat C_p/T of about 1000 $\mathrm{mJ/molK^2}$, thus ranking this compound among strongly correlated electron systems. For $PrFe_4Sb_{12}$, magnetic fields of the order of 3 T seem to suppress long range magnetic order and at some critical field C_p/T behaves proportional to $-\ln T$. Simultaneously, the low temperature resistivity changes from a T^2 behaviour at $\mu_0 H = 0$ T to an almost linear dependence for $\mu_0 H \approx 4$ T.

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